GB923238

Publication Title:

Improvements in or relating to air conditioning systems for aircraft

Abstract:

Abstract of GB923238

923,238. Ventilating aircraft &c. NORMA- LAIR Ltd. Oct. 31, 1960 [Oct. 30, 1959], No. 36858/59. Class 137. Fresh air from the engine intake 42 and pipe 41 and recirculated air from the cabin 7 and fan 10 are mixed and flow through cooler 1 and deodorizer 3 back to the cabin which has vents 30 opening automatically to give a maximum pressurization. Oxygen from supply 4 is supplied to the conditioned air downstream of deodorizer 3 when required. The cooler 1 is the evaporator of a compression refrigerating system 20, the condenser 24 of which is cooled by ram air. A cooler 40 in pipe 41 is also cooled by ram air. An ozonizer may be pro- vided.

PATENT SPECIFICATION

923,238

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Improvements in or relating to Air Conditioning Systems for Aircraft.

We, NORMALAIR LIMITED, of West Hendford, Yeovil, in the County of Somerset, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an air conditioning system for use particularly, although not exclusively in aircraft of the passenger carrying type, and more particularly, although not exclusively to such aircraft of the type that operate at high altitudes and at speeds considerably in excess of speed of sound.

Known methods of inducing air from the outside temperatures at a rate sufficient to conform with operation requirements, presents certain problems of cooling which cannot readily be overcome by normal means. In a passenger aircraft a considerable intake of oxygen would be required for say 150 passengers during a flight of 3 hours. As a result a considerable quantity of carbon dioxide will be produced as well as a substantial amount of water vapour. It is therefore of necessity for the reasons stated and further to avoid undesirable odours, to supply about 1 lb. of fresh air per person per minute for such passenger aircraft, even where there is a considerable degree of internal recirculation of the air.

It is with this problem in mind that the fololwing invention has been evolved which has for its object to offset the adverse effects due to cooling by providing a system for reducing the air flow into the cabin and thereby to reduce the cooling necessary.

[*Price* 4*s*. 6*d*.]

It is a further object of the invention to minimise the problems associated with known means for supplying the passengers with air or other breathable gases at a suitable temperature and thereby reduce the penalty of aerodynamic drag and weight associated with such means.

Accordingly the invention consists in an air conditioning system for an enclosure of an aircraft comprising first means for supplying breathable gas to said enclosure and means for recirculating said gas within said enclosure to condition same, characterised in that second means for supplying breathable gas, other than ambient air, are provided for introducing gas into said enclosure in a manner as to augment said first breathable gas supply and to dilute carbon dioxide within said enclosure.

Further objects and advantages of the invention will become readily apparent from the following detailed description with reference to the accompanying diagrammatic drawing which shows a schematic drawing of the system according to the invention.

In carrying the invention into effect according to one convenient form by way of example only, referring to the accompanying diagrammatic drawing, we provide an evaporator indicated at 1, being in communication by way of conduit 2 with a deodoriser 3 employing activated charcoal. An oxygen cylinder, liquid oxygen converter or like oxygen source 4 conveniently provided outside or within the cabin space generally indicated at 7, having a flow controller (not shown) in the supply line, is in communication with conduit 5 disposed at

the outlet of the deodoriser 3. The conduit 5 is provided with a plurality of outlets generally indicated at 6 for allowing breathable gas to be discharged to the cabin space 7. A motor driven recirculating fan indicated at 10 upstream of said evaporator 1 is provided for recirculating breathable gas from the cabin space to said evaporator 1 by way of conduit 11. A by-pass conduit 12 is provided in such a manner that some of the breathable gas for recirculation may by-pass the evaporator 1 as required. The evaporator 1 is in conduit communication with a typical aircraft cooling system for example of the compression, evaporation and condensation type generally indicated at 20, forming no part of the invention, which comprises a compressor 21 driven by an electric motor 22 in communication with an evaporator 1 by way of conduit 23. The compressor is in communcation with a condenser 24 by way of conduit 25 and the outlet of said condenser 24 is in communication with said evaporator 1 by way of conduits 26, 27 and expansion valve 28. A plurality of discharge valves generally indicated at 30 are provided in the region of the aircraft within the toilet and galley space generally indicated at 31. Air is bled from the engine air-intake 42 to conduit 11 disposed upstream of said evaporator 1 by way of heat exchanger 40 and conduit 41.

The cooling system utilises a liquid refrigerant such as dichlorotetra-fluoroethane, hereinafter referred to as the refrigerant, which in operation, leaves the compressor 21 driven by electric motor 22, in a gaseous state at a substantially high temperature and pressure and flows to condenser 24 by way of conduit 25. The refrigerant liquifies and cools, heat of lique-faction being transferred to the ram air drawn over condenser 24 by way of convenient means. The refrigerant then passes to expansion valve 28 where it partially vaporises cooling to a substantially low temperature with a corresponding reduction in pressure. The refrigerant on leaving expansion valve 28, flows to evaporator 1 where it is entirely converted to gas and thereby air from the engine air intake 42 and recirculation air from cabin space 7 passing through evaporator 1 by way of conduit 11 is cooled by evaporation of the refrigerant within evaporator 1. The refrigerant is finally returned to compressor 21 by way of conduit 23.

In operation of the system according to the invention, external air is supplied from the engine air intake 42 at relatively high temperature to evaporator 1 by way of conduits 41 and 11, the temperature thereof being substantially reduced by heat exchanger 40, where heat is given up to ram air passing over said heat exchanger 40. The air is further reduced in temperature and substantially dried by the action of the evaporator 1 due to the operation of the cooling system 20 as hereinbefore described. The air then passes by way of conduit 2 to deodoriser 3, where any obnoxious odours are removed therefrom. The air is then discharged into the cabin space 7 by way of outlets 6 in conduit 5.

Upon discharge into the cabin space 7, the air is used for normal breathing purposes and it will be realised that air normally exhaled will contain carbon dioxide and water vapour. Also air within the cabin space 7 may contain any odours which may originate from the passengers.

The air in the cabin space 7 is therefore recirculated to ensure an even distribution of conditioned air therein in part, by recirculation over the evaporator 1 by way of a fan 10 and conduit 11, where any water vapour is removed. The air is then passed by way of conduit 2 to deodoriser 3 where any obnoxious odours contained therein are removed as hereinbefore described. The air is also adapted, in part to by-pass the evaporator 1 by way of by-pass 12 to prevent excess dehumidification.

If no effort is made to replace oxygen consumed by the passengers, the oxygen percentage will fall. Provided the selected equivalent operating altitude of the cabin is sufficiently low, the slight reduction in the oxygen percentage is acceptable, otherwise a metered flow of oxygen in the cabin space 7 is required equal to the average consumption of the occupants. In order to effect this and also to dilute the carbon dioxide within the cabin space 7, additional oxygen may be supplied from oxygen container 4 by way of a flow controller (not shown).

It will be apparent that due to air being continually supplied from the engine air intakes 42 by way of heat exchanger 40 to cabin space 7 and also oxygen being supplied from the oxygen container 4, pressure within the cabin space 7 will rise, and to control this pressure, a plurality of discharge valves 30 are provided. The discharge valves 30 are adapted to open at a predetermined pressure and allow air to be discharged from the cabin space 7 to the atmosphere. At operational altitudes the pressure within the cabin space 7 will always be in excess of the pressure of the surrounding atmosphere and therefore an outflow of air will always be experienced from the cabin. The discharge valves 30 are therefore positioned within the toilet and galley space 31 in order that the flow of air to atmosphere, may at the same time, remove a quantity of the obnoxious odours therein.

Often a small quantity of ozone is desirable to act as a disinfectant and although this exists in the outer atmosphere and is

obviously introduced to the cabin space 7 by way of engine air intakes 42 it may be found that this is totally destroyed by the high temperatures in the engine. In this case it will be necessary to provide an ozoniser for this purpose which may comprise electrical means operated by H.T. supply.

It will be appreciated and understood by those skilled in the art that numerous modifications and refinements may be carried out without departing from the scope of the invention and the system hereinbefore described has numerous applications and is not necessarily restricted to aircraft of the supersonic high altitude passenger carrying type.

WHAT WE CLAIM IS:—

1. An air conditioning system for an enclosure of an aircraft, comprising means for supplying breathable gas to said enclosure and means for recirculating said gas within said enclosure to condition same, characterised in that supplementary means for supplying oxygen or breathable oxygen mixture, other than ambient air, are provided for introducing gas into said enclosure in a manner as to augment said breathable gas supply and to dilute carbon dioxide within said enclosure.

2. An air conditioning system as claimed in Claim 1, and including a plurality of discharge valves for discharging gas from said enclosure such that a predetermined pressure is maintained therein.

3. An air conditioning system as claimed in Claim 1, and further including heat exchange means for cooling gas from said means for supplying breathable gas before discharge into said enclosure.

4. An air conditioning system as claimed in Claim 3, wherein said heat exchange means comprise a first heat exchanger cooled by air flow, and a second heat exchanger comprising an evaporator of a refrigeration system.

5. An air conditioning system as claimed in Claim 4, wherein said refrigeration system is of the closed circuit compression, condensation and evaporation type.

6. An air conditioning system as claimed in Claim 4, wherein said gas from said means for supplying breathable gas after being cooled by said second heat exchanger, is passed through de-odourising means, and gas from said supplementary means is introduced to augment said first supply before discharge into said enclosure.

7. An air conditioning system as claimed in Claim 4, wherein said second heat exchanger has by-pass means associated therewith.

8. An air conditioning system as claimed in Claims 1—7, wherein said means for recirculating said gas within said enclosure comprise a motor driven fan adapted to recirculate gas from said enclosure and pass same in part over said second heat exchanger thereby removing water vapour therefrom and in part by said by-pass means, said gas being de-odourised and augmented by way of gas from said supplementary means, before discharge to said enclosure.

9. An air conditioning system as claimed in Claim 8, wherein said recirculated gas so augmented dilutes any carbon dioxide within the enclosure in addition to maintaining the oxygen level therein.

10. An air conditioning system as claimed in Claim 2, wherein said discharge valves are disposed within toilet and galley space in such a manner that outflow of air from said space removes a substantial quantity of odours therefrom.

11. An air conditioning system as claimed in Claim 10, and including ozonising means within said cabin space for disinfectant purposes.

12. An air conditioning or like system for an enclosure of an aircraft, characterised by a cabin space having means for supplying breathable gas thereto, fan means for recirculating breathable gas therein, breathable gas augmenting means such as a pressure bottle, liquid gas converter or the like, for diluting carbon dioxide therein, deodourizing means and means for partially dehumidifying said breathable gas, ozonising means for disinfectant purposes and a plurality of discharge valves for discharging excess gas from said cabin space.

13. An air conditioning system for an enclosure of an aircraft substantially as hereinbefore described with reference to the accompanying drawings.

For the Applicants,
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from which copies may be obtained.

923238 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*